

Nucleus and Radiation (chapter 30 and 31)

Rutherford found that there must be a dense positive part of the atom, the nucleus.

The nucleus is composed of protons and neutrons.

The atomic number, Z , is the number of protons in the nucleus and it specifies the element.

Hydrogen has 1 proton

Helium has 2

(see periodic table)

The atomic mass number, A , is the number of neutrons and protons in the nucleus.

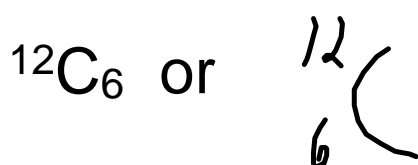
atoms with the same atomic number but different atomic mass are called, isotopes.

eg.

carbon 12 and carbon 14 are isotopes of carbon.

carbon 12 has 6 protons and 6 neutrons

carbon 14 has 6 protons and 8 neutrons



atomic mass: is the average mass in u of the isotopes

isotopic mass is the mass of that isotope

carbon 12 has a mass of exactly 12.00000000 u

because that is the definition of $u = 1/12 \text{ } ^{12}\text{C}$

while carbon 14 has a mass of

14.003241 u

p618 Q1-4

define alpha, beta and gamma radiation

Radioactive decay - when an unstable isotope emits particles and/or energy.

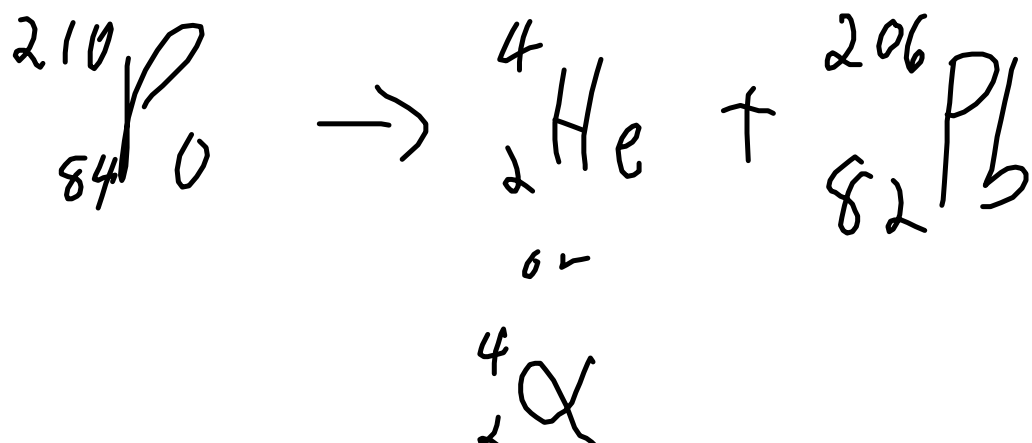
Alpha Decay, α

unstable isotope emits a helium 4 nucleus

low penetration - blocked by a piece of paper

toxic - used to be used in smoke detectors

eg. Polonium 210 $^{210}\text{Po}_{84}$ decays by an alpha decay, write the decay equation:



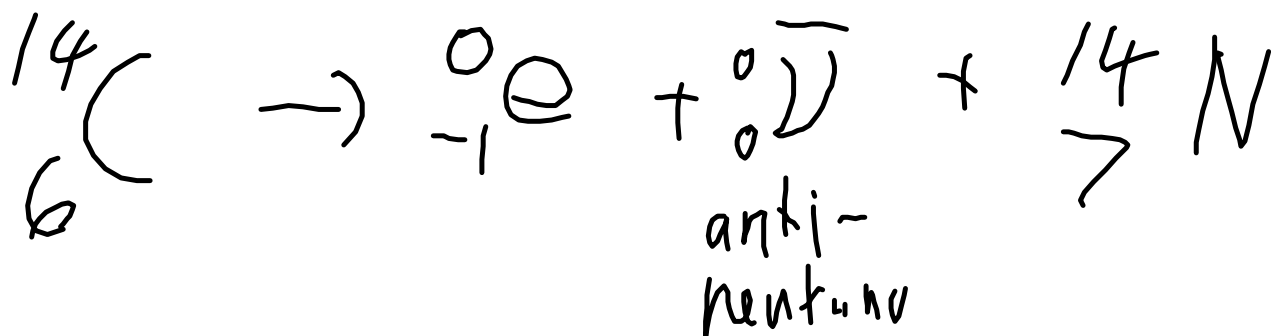
beta decay, β is when a -
 beta negative decay - electron and anti-neutrino are emitted from the nucleus changing a neutron into a proton
 beta positive decay - positron (positive electron) and neutrino are emitted changing a proton into a neutron

- both have moderate penetration - blocked by lead

neutrinos are highly unreactive particles, very hard to observe. They can go through a light year of water without interacting.

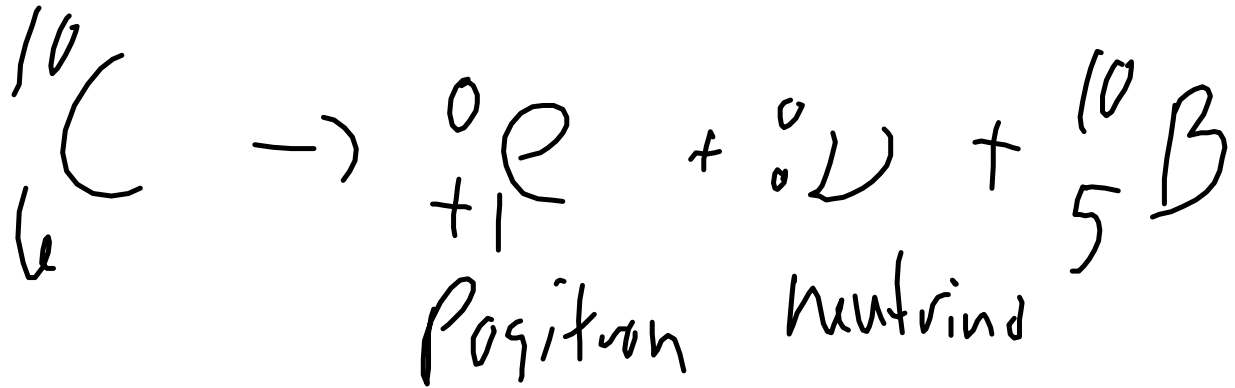
positrons are anti-matter electrons. Same mass, but opposite charge. When they hit an electron they annihilate with all the mass changing into gamma ray energy.

Carbon 14 decays by beta negative decay,



- greek letter
nu

Carbon 10 decays by beta positive decay



Gamma radiation, γ

high energy photon of electromagnetic energy

high penetration - goes through lead

doesn't change the nucleus except makes it more stable.

Homework:

p621 Practice problems 5-8 - research notes for your presentation.